CLAIMS

What is claimed is:

1. A parametric audio system for generating at least one airborne audio beam, comprising:

at least one audio signal source configured to provide at least one audio signal;

a modulator configured to receive a first signal representative of the audio signal and to convert the first signal into ultrasonic frequencies; and

an acoustic transducer array including at least one acoustic transducer, the array being configured to receive the converted first signal and to project the converted first signal through the air along a selected path, thereby regenerating the audio signal along at least a portion of the selected path,

wherein the acoustic transducer array has a bandwidth greater than 5 kHz.

2. The parametric audio system of claim 1 wherein each acoustic transducer is a membrane-type transducer.

3. The parametric audio system of claim 2 wherein the membrane-type transducer is a Sell-type electrostatic transducer.

4. The parametric audio system of claim 2 wherein the membrane-type transducer further includes a conductive membrane, a backplate electrode, and a DC bias source between the conductive membrane and the backplate electrode.

5. The parametric audio system of claim 4 further including

at least one driver amplifier coupled between the modulator and the acoustic transducer array and configured to receive the converted first signal and to generate an amplified signal representative of the converted first signal, and

a blocking capacitor coupled between the driver amplifier and the acoustic transducer array and configured to block the DC bias from the driver amplifier.

6. The parametric audio system of claim 4 further including

at least one driver amplifier coupled between the modulator and the acoustic transducer array and configured to receive the converted first signal and to generate an amplified signal representative of the converted first signal, and

a first component coupled between the acoustic transducer array and the DC bias source and configured to block the amplified signal from the DC bias source.

7. The parametric audio system of claim 4 wherein the DC bias source is provided by an embedded charge.

8. The parametric audio system of claim 3 wherein the Sell-type electrostatic transducer includes a conductive membrane, a backplate electrode, and a dielectric spacer disposed between the conductive membrane and the backplate electrode.

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9. The parametric audio system of claim 2 wherein the membrane-type transducer is a Sell-type electrostatic transducer including a conductive membrane, an electrode, and an insulative backplate disposed between the conductive membrane and the electrode.

10. The parametric audio system of claim 1 further including a circuit configured to perform nonlinear inversion of the audio signal to generate the first signal.

11. The parametric audio system of claim 1 further including

at least one driver amplifier coupled between the modulator and the acoustic transducer array and configured to receive the converted first signal and to generate an amplified signal representative of the converted first signal, and

a matching filter configured to compensate for a non-flat frequency response of the combination of the acoustic transducer array and the driver amplifier.

12. The parametric audio system of claim 1

wherein the at least one acoustic transducer comprises a membrane-type transducer,

wherein the membrane-type transducer has a loudness figure of merit, l, defined according to the expression l = (Area) • $(\text{Amplitude})^2$, and

wherein "Area" is the area of the membrane-type transducer and "Amplitude" is the amplitude of the modulated carrier signal.

13. The parametric audio system of claim 12 wherein "l" is greater than (2.0×10^4) $Pa^2 \bullet in^2$.

14. The parametric audio system of claim 12 wherein "l" is greater than (4.5×10^5) $Pa^2 \bullet in^2$.

~~15~~. A parametric audio system for generating at least one airborne audio beam, comprising:

at least one audio signal source configured to provide at least one audio signal;

a modulator configured to receive a first signal representative of the audio signal and to modulate an ultrasonic carrier signal with the first signal;

at least one driver amplifier configured to receive the modulated carrier signal and to generate an amplified signal representative of the modulated carrier signal; and

an acoustic transducer array including at least one acoustic transducer, the array being configured to receive the modulated carrier signal and to project the modulated carrier signal through the air along a selected path, thereby demodulating the modulated carrier signal to regenerate the audio signal along at least a portion of the selected path,

wherein the driver amplifier includes an inductor coupled to a capacitive load of the acoustic transducer array to form a resonant circuit having a resonance frequency approximately equal to the frequency of the ultrasonic carrier signal.

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16. The parametric audio system of claim 15 wherein the frequency of the ultrasonic carrier signal is greater than or equal to 45 kHz.

17. The parametric audio system of claim 15 wherein the frequency of the ultrasonic carrier signal is greater than or equal to 55 kHz.

18. The parametric audio system of claim 15 wherein the driver amplifier further includes a damping resistor coupled between the inductor and the capacitive load of the acoustic transducer array.

19. The parametric audio system of claim 15 wherein the driver amplifier further includes a step-up transformer and the inductor is provided by the step-up transformer.

20. A parametric audio system for generating at least one airborne audio beam, comprising:

at least one audio signal source configured to provide at least one audio signal;

a modulator configured to receive at least one first signal representative of the audio signal and to convert the at least one first signal into ultrasonic frequencies;

at least one driver amplifier configured to receive the at least one converted first signal and to generate at least one amplified signal representative of the converted first signal;

an acoustic transducer array including a plurality of acoustic transducers, the array being configured to receive the at least one converted first signal and to project the

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converted first signal through the air for subsequent regeneration of the audio signal; and

a delay circuit configured to apply at least one predetermined time delay to the at least one converted first signal.

21. The parametric audio system of claim 20 wherein the delay circuit is configured to apply the at least one predetermined time delay to the at least one converted first signal to steer the converted first signal through the air along at least one path by the acoustic transducer array.

22. The parametric audio system of claim 20 wherein the acoustic transducer array further includes a membrane disposed along an adjacent backplate, the backplate including a plurality of depressions formed on a surface thereof, and each acoustic transducer being defined by the membrane and one or more of the depressions.

23. The parametric audio system of claim 22 wherein the dimensions of the respective depressions are set to determine the center frequency and the bandwidth of the respective acoustic transducers.

24. The parametric audio system of claim 20 wherein the delay circuit is configured to apply a predetermined time delay, d, according to the expression $d = (x \bullet \sin(\theta))/c$, wherein "x" is the distance from a datum to a respective acoustic transducer and "c" is the speed of sound.

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~~25~~. An acoustic transducer array, comprising:

a backplate including a surface and a plurality of respective depressions of varying dimensions formed on the surface; and

a membrane adjacently disposed along the backplate,

wherein the membrane and at least one of the plurality of respective depressions define at least one acoustic transducer, and

wherein the dimensions of the respective depressions are set to determine the center frequency and the bandwidth of the at least one acoustic transducer.

26. The acoustic transducer array of claim 25 wherein the acoustic transducer array has a bandwidth greater than 5 kHz.

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